

TITLE OF THE INVENTION

REDUCED IMAGE FORMING METHOD AND APPARATUS

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BACKGROUND OF THE INVENTION

Field of the Invention

10 The present invention relates to reduced image forming method and apparatus which are suitable for an electric filing apparatus for searching, displaying, and printing image data of a document stored with relation to predetermined managing information, etc.

Description of the Related Art

15 Recently, there has been published an electric filing apparatus for storing image data of a document formed by reading the document by a scanner, etc. with relation to document managing information and searching, displaying, printing the information, and the like. According to the electric filing  
20 apparatus, hitherto, in case of registering document managing information such as a document name, a number of pages, registered date, and a keyword, as and displaying a document list and a search result list, etc., the document managing information is displayed as information for identifying the document.  
25 However, it is difficult to identify the outline of the document

by using only the document managing information. This situation results in further proposing an electric filing apparatus capable of forming and registering a reduced image of the document and displaying the reduced image in the document list and search result list.

Fig. 10 is a diagram showing a functional construction example of a general electric filing apparatus for displaying a reduced image in a document list and a search result list. The electric filing apparatus has: a document reading function unit 1000; a reduced image forming function unit 1001; a document storing function unit 1002; and a display control function unit 1003, as exemplified in Fig. 10. Among them, the document reading function unit 1000 reads image data of a document by a scanner device, etc. (not shown). The reduced image forming function unit 1001 forms image data which is reduced with a proper size by thinning out a dot, etc. from the image data of the document read by the document reading function unit 1000. The document storing function unit 1002 stores the image data of the document read by the document reading function unit 1000 and the reduced image data of the document formed by the reduced image forming function unit 1001, with the relation therebetween. The display control function unit 1003 controls an operation for displaying the image data of the document and the reduced image which are stored in the document storing function unit 1002, for instance, displays a document list based on the reduced image

shown in Fig. 11.

However, according to the conventional electric filing apparatus, in case of displaying the document list and the search result list, the outline of the document can be identified from the reduced image of the document, but only a layout of the whole document can be identified and a character written to the document cannot discriminated. This arises a problem that it is extremely difficult to identify a document having a similar layout and a document having no distinctive feature which has not large character and no figure from the reduced image. A preferable example is a reduced displaying example of a patent specification shown in Fig. 12.

The example indicates the reduced image of 2 pages in a publication of a US. patent application, and it is impossible to discriminate what is written in both of the pages displayed in the right and left in the least.

#### SUMMARY OF THE INVENTION

The present invention is devised in view of the aforementioned problems. It is an object of the present invention to form a reduced image capable of easily identifying the contents of even a document having a similar layout and a document having no distinctive feature in case of displaying a list of documents and a search result list.

To accomplish the object, according to one construction

of the present invention, there is provided a reduced image forming apparatus, comprising:

extracting means for extracting a plurality of partial images from an original image;

5        generating means for combining the plurality of partial images extracted by the extracting means and generating a combined image smaller than the original image; and

indicating means for indicating the combined image generated by the generating means.

10        To accomplish the object, according to another construction of the present invention, there is provided a reduced image forming apparatus, comprising:

converting means for converting an original image into a character train;

15        extracting means for extracting a partial character train from the character train converted by the converting means;

generating means for combining a plurality of partial character trains extracted by the extracting means, converting the combined partial character trains into an image, and

20        generating a combined image smaller than the original image; and

indicating means for indicating the combined image generated by the generating means.

#### BRIEF DESCRIPTION OF THE DRAWINGS

25        Fig. 1 is a block diagram showing an outline of an apparatus

Fig. 2 is a block diagram showing a functional construction of the electric filing apparatus according to the present

Fig. 3 is a flowchart for explaining an operation of the electric filing apparatus according to the present embodiment;

Fig. 5 is a diagram for explaining the division into a

10 partial image and the extraction of the partial image according  
to the present invention;

Fig. 6 is a diagram for explaining a state in which reduced images are combined by using the extracted partial image shown in Fig. 5;

15            Fig. 7 is a diagram showing a display form of the reduced  
image according to the present embodiment;

Fig. 8 is a diagram for explaining the division into the partial image and the extraction of the partial image according to a modified example;

20            Fig. 9 is a diagram for explaining a state in which the  
reduced images are combined by using the extracted partial image  
shown in Fig. 8;

Fig. 10 is a diagram showing a functional construction example of a general electric filing apparatus for displaying  
25 the reduced image in the document list and the search result list;

Fig. 11 is a diagram showing an example to display the list of the documents on the basis of the reduced image in the general electric filing apparatus;

Fig. 12 is a diagram showing an example to display the list of the documents on the basis of the reduced image in the general electric filing apparatus;

Fig. 13 is a block diagram showing a functional construction of an electric filing apparatus according to a second embodiment;

Fig. 14 is a flowchart for explaining an operation of the electric filing apparatus according to the second embodiment;

Fig. 15 is a diagram for explaining the division into a partial character train and the extraction of the partial character train according to the second embodiment and a third embodiment;

Fig. 16 is a diagram for explaining a state in which the reduced images are combined by using the extracted partial image or partial character train shown in Figs. 5 and 15;

Fig. 17 is a block diagram showing a functional construction of an electric filing apparatus according to the third embodiment; and

Fig. 18 is a flowchart for explaining an operation of the electric filing apparatus according to the third embodiment.

Three embodiments will be described with reference to the accompanied drawings hereinbelow.

(First embodiment)

Fig. 1 is a block diagram showing an outline of an apparatus construction of an electric filing apparatus according to the present embodiment. Reference numeral 101 denotes a CPU which executes various control operations in the electric filing apparatus on the basis of the a control program stored in an ROM 102 and an RAM 103; 102 the ROM which stores the control program executed by the CPU 101 and various data; and 103 the RAM which provides an area to store the control program executed by the CPU 101 and a work area of the CPU 101.

Reference numeral 104 denotes an input device having a keyboard or pointing device; 105 a display which displays various images under the control operation by the CPU 101; 106 an external storage device which stores image data and a varieties of application programs; and 107 a scanner which reads an original image optically and converts the read image into digital data which is processable by the CPU 101.

Fig. 2 is a block diagram showing a functional construction of the electric filing apparatus according to the present embodiment. Referring to Fig. 2, reference numeral 1 denotes an image dividing process function unit; 2 a partial image extracting process function unit; 3 a reduced image combining process function unit; 4 a document registering function unit;

5 a filing device; 6 a display control function unit; 7 a selecting function unit; 8 an input device; 9 an output device; and 10 a document reading function unit. Note that the CPU 101 executes the control program which is loaded in the RAM 103 from the external storage device 106 and controls the scanner 107 and external storage device 106, thereby realizing the function units.

Fig. 3 is a flowchart for explaining the operation of the electric filing apparatus according to the present embodiment.

10 The operation of the present embodiment will be described with reference to Figs. 2 and 3 hereinbelow.

To start with, the document reading function unit 10 inputs document image data as a processing target from the input device 8 (such as the scanner 107 and external storage device 106) and stores the data into the memory (RAM 103) (step S11). The document image data may be data of a 400dpi-resolution which is read by the scanner 107 in real time or may be data which is previously read and stored in the external storage device 106.

20 The image dividing process function unit 1 uniformly divides the document image data stored in the RAM 103 by a predetermined dividing number, thereby dividing the document image data into a plurality of image blocks (step S12).

According to the present embodiment, an image 20 (one page of a publication of a US. patent application) of an A4 size is uniformly divided into four blocks, as shown in Fig. 4. Fig.

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4 is a conceptual diagram showing the document image data stored in the RAM 103. The divided blocks are labeled as image blocks A, B, C, and D (21 to 24). It is a purpose of this division to extract features from the four portions in the uniform arrangement on the image.

The partial image extracting process function unit 2 extracts a partial image having a predetermined amount (a predetermined size) from each image block which is divided by the image dividing process function unit 1 (step S13). It is noted that the extracting amount is determined dependently upon a rate of the size of the reduced image on the display 105 and the size of the original image on paper.

Normally, a plurality of reduced images are displayed in a reduced image list. If assuming that the size of an image is equal to about 5 cm, for example, on a 17inch-display, it is possible to display eight reduced images.

An image corresponding to the A4 size has a width of about 20 cm, so that the reduction ratio is set to 1/4 one-dimensionally. That is, the reduction ratio is equal to 1/16 on the area. Accordingly, if extracting only an area of 1/16 from each image block shown in Fig. 4, the sum of width of four image blocks is equal to about 5 cm on the display.

Therefore, according to the present embodiment, each image block is uniformly divided into sixteen partial images, as shown in Fig. 5, and the partial image is extracted from the image blocks

one by one. According to the present invention, the selecting function unit 7 is set to select the head partial image in each image block. Four partial images (501 to 504) as shown by hatched portions in Fig. 5 are extracted.

5       The reduced image combining process function unit 3 vertically aligns the partial images extracted by the partial image extracting process function unit 2, thereby constructing one reduced image, as shown in Fig. 6, and stores the reduced image into the memory (RAM 103) (step S14). In other words, the  
10   constructed reduced image is composed of an extracted partial image 601 of an image block A21, an extracted partial image 602 of an image block B22, an extracted partial image 603 of an image block C23, and an extracted partial image 604 of an image block D24, in the descending order. Further, the thus-combined image  
15   is reduced within a range in capable of discriminating a character.

      Since the resolution of a CRT is normally equal to about 100dpi, the size capable of recognizing one character on the CRT is limited to about 2 mm every character width. The original  
20   used in the present embodiment is a publication of a US. patent application, and the size of one character is about 2mm on the paper. Because the image in this example is scanned by the scanner 107 having the 400dpi-resolution, the image is reduced to 1/4. The reduced image is displayed on a window 701 on a screen  
25   of the display 105 as reduced images (702, 703) via the display

control function unit 6, as shown in Fig. 7. Incidentally, Fig. 7 shows to display the reduced image obtained by the processes.

The document registering function unit 4 registers the document image data read by the document reading function unit 10 and the reduced image processed by the reduced image combining process function unit 3 into the file device 5 with relationship therebetween (step S16). The file device 5 stores the document image data and document managing information such as a keyword with a relation therebetween as a database. The display control function unit 6 controls an operation to display the image data in a character area stored in the file device 5 to the output device 9 (such as the display 105). Incidentally, although the CRT is used as a display in the present embodiment, not only the CRT but also an LCD may be used if using them as a display.

As mentioned above, according to the present embodiment, the image extracted from a plurality of areas in one page is reduced and indicated within a decidable range, so that the operator can discriminate the contents of the indicated document easily. That is, even with respect to a document having a similar layout or a document with no distinctive feature, so long as the reduced image is used, the character can be recognized throughout the document, though a part of the document is one part. Therefore, it is able to identify the document easily.

Normally, a document has a margin and the publication of the US. patent application is set to have a margin of about 1/16

vertically. On the contrary, the selecting function unit 7 shown in the embodiment is set to uniquely select the head portion of each image block. A space portion is extracted in portions of the image blocks A21 and C23 as a result of the combination of the reduced images, as shown by 601 and 603 in Fig. 6. The quantity of information is decreased and the advantage is decreased to the half (no feature is extracted from the portions of the image blocks A21 and C23).

Setting values of the selecting function unit 7 may be set to extract the partial images which are located at the second order from the head in the image blocks A21 and C23, and to extract the head partial images from the image blocks B22 and D24. When setting the foregoing, hatched portions 801 to 804 shown in Fig. 8 become an extraction target. Consequently, with regard to a combined reduced-image as shown in Fig. 9, the partial image 801 in Fig. 8 becomes an extracted partial image 901; the partial image 802 in Fig. 8 an extracted partial image 902; the partial image 803 in Fig. 8 an extracted partial image 903; and the partial image 804 in Fig. 8 an extracted partial image 904. As compared with those in Fig. 6, the quantity of information can be increased.

(Second embodiment)

A second embodiment according to the present invention will be described in detail with reference to the accompanied drawings hereinbelow.

The outline of an apparatus construction is as same as that of Fig. 1 which has been described in the first embodiment.

Fig. 13 is a block diagram showing a functional construction of an electric filing apparatus according to the present embodiment. Referring to Fig. 13, reference numeral 1300 denotes a character recognizing process function unit; 1301 a whole character train dividing process function unit; 1302 a partial character train extracting process function unit; 1303 a reduced image combining process function unit; 1304 a document registering function unit; 1305 a file device; 1306 a display control function unit; 1307 a selecting function unit; 1308 an input device; 1309 an output device; and 1310 a document reading function unit. Incidentally, the CPU 101 executes the control program loaded in the RAM 103 from the external storage device 106 and controls the scanner 107 and the external storage device 106, etc., thereby realizing the function units.

Fig. 14 is a flowchart for explaining the operation of the electric filing apparatus according to the present embodiment. The operation according to the present embodiment will be described with reference to Figs. 13 and 14 hereinbelow.

First of all, the document reading function unit 1310 inputs document image data as a processing target from the input device 1308 (such as the scanner 107 and external storage device 106) and stores the image data into the memory (RAM 103) (step S41). The document image data may be data of a 400dpi-resolution

which is read by the scanner 107 in real time or may be data which is previously read and stored in the external storage device 106. The character recognizing process function unit 1300 reads an image from the memory (RAM 103) and outputs the recognized

5 character. According to the present embodiment, in case of two or more spaces are successive, the character recognizing process function unit 1300 outputs only one space and outputs only one space in case of a carriage return line feed control code. The output by the character recognizing process function unit is  
10 obtained by coupling a character train as a set of sequent characters including no space by using a space. In other words, the output is a character train of the whole one page (step S40).

The image processing function unit 1301 uniformly divides the character train stored in the RAM 103 by a predetermined  
15 dividing number, thereby dividing the character train into a plurality of character train blocks (step S42).

According to the present embodiment, an image of the A4 size (1-page character information of the publication of the US. patent application) is divided into four blocks uniformly, as  
20 shown in Fig. 15. Fig. 15 is a diagram for explaining the division of the partial character train stored in the RAM 103 and the extraction of the partial character train. The divided blocks are labeled as character train blocks A, B, C, and D (21 to 24). It is a purpose of this division to extract features  
25 from the four portions in the uniform arrangement on the image.

The partial character train extracting process function unit 1302 extracts a partial character train having a predetermined amount (a predetermined size) from each character train block which is divided by the character train dividing process function unit 1301 (step S43).

It is noted that the sequence after extraction has been described in the first embodiment, so that it is omitted herein. The partial character trains extracted in step S44 are combined, the combined image is displayed in step S45, and the combined image is registered in step S46.

Reference numeral 1602 in Fig. 16 denotes the reduced image obtained by the processes.

Incidentally, it is premised that to manually set the selection from among the extracted partial character trains by the selecting function unit 1307 in the foregoing. According to the present embodiment, the following conditions are fixed, namely, whether or not one is selected if there are two or more font kinds, font sizes, character intervals, or spaces; whether or not a carriage return line feed; CRLF) code is removed; whether a spacing of the English word lap is ON/OFF; and the like.

However, it is possible fully to select whether each setting by the selecting function unit 1307 is fixed or unfixed. If the setting is fixed, of course, each arbitrary setting can be performed manually. If the setting is unfixed, it is able to decide the setting automatically in accordance with the image

information as a processing target. For instance, a standard character size on an OS is picked up and the best number of characters is automatically determined. On the other hand, it is possible fully to designate the number of characters and  
5 adjust the font size. If deciding the dividing number of character train blocks or the character number of the partial character train manually and arbitrarily, this case is included in the range of the present invention.

It is possible to select the position of the partial  
10 character train used for the reduced image, so that the document information is obtained advantageously.

As mentioned above, according to the present embodiment, the whole character train in the one page is combined with the partial character train extracted from a plurality of areas,  
15 thereby forming the reduced image, and thus the character is displayed within the decidable range, and the operator can discriminate the document contents indicated easily. That is, even with respect to the document with a similar layout and the document having no distinctive feature, the characters in the  
20 whole reduced image can be recognized, though the document is one part, using only the reduced image. As a result, the document can be identified easily.

Further, it is able to avoid a margin and a space by a carriage return line feed, etc. shown by 1601 in Fig. 16, as shown  
25 by 1602 in Fig. 16. It is possible to provide a reduced image



having a large amount of information.

(Third embodiment)

A third preferred embodiment according to the present invention will be described in detail with reference to the accompanied drawings hereinbelow.

The outline of an apparatus construction is as same as that of Fig. 1 which has been described in the first embodiment.

Fig. 17 is a block diagram showing a functional construction of an electric filing apparatus according to the present embodiment. Referring to Fig. 17, reference numeral 1700 denotes an application data character train extracting process function unit; 1701 a whole character train dividing process function unit; 1702 a partial character train extracting process function unit; 1703 a reduced image combining process function unit; 1704 a document registering function unit; 1705 a file device; 1706 a display control function unit; 1707 a selecting function unit; 1708 an input device; 1709 an output device; and 1710 an application data reading function unit.

Incidentally, the CPU 101 executes the control program loaded in the RAM 103 from the external storage device 106 and controls the external storage device 106, thereby realizing the function units.

Fig. 18 is a flowchart for explaining the operation of the electric filing apparatus according to the present embodiment.

The operation according to the present embodiment will be

described with reference to Figs. 17 and 18 hereinbelow.

First of all, the application data reading function unit 1710 is constructed by a software module, etc. which is the so-called "Outside In Viewer Technology" produced by INSO Corporation, and inputs application data (\*.doc) formed by application software (e.g., "Microsoft Word" produced by Microsoft Corporation) from the input device 1708 (such as the external storage device 106) and stores the inputted data into the memory (RAM 103) (step S51). Note that the software module cannot read all of the application data, but a filter corresponding to a desired application is previously optionally installed, thereby making it possible to read the application data corresponding thereto, displaying the application data, and outputting the character included in the application data.

The application data character train extracting process function unit 1700 reads the characters in the application data from the memory (RAM 103), and converts the read character into a word. According to the present embodiment, when two or more spaces are successive, the spaces are replaced with one space. In the case where there is a carriage return line feed code, the code is also replaced with one space. Therefore, the output by the application data character train extracting process function unit 1700 is obtained by coupling a successive character train by using a space. In other words, the output is a set of character trains of the whole head page. The output is shown by 420 in

Fig. 15 (step S50).

The whole character train dividing process function unit 1701 uniformly divides the application data stored in the RAM 103 by a predetermined dividing number, thereby dividing the application data into a plurality of image blocks (step S52).

According to the present embodiment, Fig. 15 shows a diagram to uniformly divide into four blocks, a whole character train 420 having a proper amount which corresponds to the A4 size (1-page character information of the publication of the US. patent application) upon printing. The divided blocks are labeled as character train blocks A, B, C, and D (121 to 124). It is a purpose of this division to extract features from the four portions in the uniform arrangement on the whole character train.

The partial character train extracting process function unit 1702 extracts a partial character train having a predetermined amount (only a predetermined character) from each character train block which is divided by the whole character train dividing process function unit 1701 (step S53). It is noted that the sequence after extraction has been described in the first embodiment, so that it is omitted herein, and the partial character trains extracted in step S54 are combined, the combined image is displayed in step S55, and the combined image is registered in step S56.

Reference numeral 1602 in Fig. 16 denotes the reduced image

obtained by the processes.

Incidentally, although it is premised to manually set the selection of the extracted partial image by the selecting function unit 1707 in the foregoing, the selection may be set automatically. The detail has been described in the second embodiment, and therefore the description is omitted.

The present embodiment shows an example wherein although the reduced image combining process function unit 1703 converts the combined character train into the image and outputs the converted data as an image, a similar advantage is also obtained by outputting the combined character train to the display control function unit 1706 as a character as it is.

Herein, an example for selecting and displaying the document image will be described simply by using the thus-registered document image data and reduced image.

First, in order to select the document image, the user instructs the display of the list of the reduced images from the input device 104. Under the instruction, the CPU 101 sequentially reads out the reduced images stored in the external storage device 106, and displays the list on the display 105. As shown in Fig. 7, a reduced image list window 701 is displayed on the display 105, and the list of the reduced images is displayed in the window. With regard to the reduced image displayed in the window 701, a divided position is displayed by a solid line 704 having a color different from that of the image so as to

clearly identify the divided position. However, if it is unnecessary that the solid line is clearly identified, the display of the reduced image is not limited to the foregoing.

The user instructs the selection of one reduced image from  
5 the reduced images which are displayed in the list by using the input device 104. Under the instruction, the CPU 101 reads out the document image for the instructed reduced-image from the external storage device, sets a document image display window on the display 105, and displays the document image which is read  
10 out in the window.

According to the three embodiments, it is able to easily understand that the foregoing is the contents regarding the reduced-image formation which is preferable to an electric filing apparatus for searching, displaying, and printing image  
15 data of a document stored with relation to predetermined managing information as exemplified in Figs. 6 and 9.

According to the present invention, it is possible to form a reduced image capable of easily identifying the contents of even the document with a similar layout and the document with  
20 no distinctive feature in the display of the document list and search result list.

Although one reduced image corresponds to the document comprising one page in the three embodiments, the reduced image is generated for one selected page (such as a front page of a  
25 publication of a US. patent application) in the document

comprising a plurality of pages and the generated reduced-image may correspond to the document comprising a plurality of pages.

Although it is premised to manually set the selection from among the extracted partial images by the selecting function unit 7 in Fig. 2, the selecting function unit 1307 in Fig. 13, and the selecting function unit 1707 in Fig. 17, the selection can be automatically determined in accordance with the image information as a processing target. For example, it is discriminated whether or not the amount of black pixels is larger than a predetermined value for each partial image which is obtained by the division as shown in Fig. 8, and it is sufficient to adopt a partial image whose amount of black pixels is larger than the predetermined value.

It is noted that although the electric filing apparatus according to the present embodiment has various component elements for realizing functions for searching and printing the information of the document stored in the file device 5, 1305, or 1705 shown in Fig. 2, 13, or 17, other than the foregoing, this description is omitted herein.

Although the embodiment indicates an image shown in Fig. 6 or 9 as a reduced image, it is sufficient to have a function for displaying a normal reduced image in accordance with an instruction by the operator if he/she is interested in the layout of pages.

The present invention may be applied to a system comprising

a plurality of pieces of equipment (such as a host computer, interface equipment, a reader, and a printer), alternatively to an apparatus comprising single equipment (such as a copying machine and a facsimile apparatus).

5           Obviously, the object of the present invention also can be attained by supplying to a system or an apparatus, a storage medium (or recording medium) which records a program code of software for implementing the functions of the embodiments, and by reading out and executing the program code stored in the  
10   storage medium by a computer (or CPU or MPU) in the system or apparatus. In this case, the functions of the aforementioned embodiments are implemented by the program code itself which is read out from the storage medium and the present invention comprises the storage medium which stores the program code.  
15   Obviously, the present invention includes a case wherein the functions of the aforementioned embodiments can be effected not only by executing the program code which is read out by the computer, but also by executing a part or all of the actual processes by the OS (Operating System) which operates on the  
20   computer on the basis of the instruction of the program code.

          Obviously, the present invention further includes a case wherein the functions of the aforementioned embodiments can be effected by writing the program code read-out from the storage medium into a memory provided for a function expansion card  
25   inserted to the computer or a function expansion unit connected

